

A NEW *LIRIOMYZA* SPECIES FROM TAIWAN (DIPTERA: AGROMYZIDAE)

SHIUH-FENG SHIAO AND WEN-JER WU

Department of Plant Pathology and Entomology, National Taiwan University,
Taipei, Taiwan 106, Republic of China

Abstract.—*Liriomyza litorea* NEW SPECIES from Taiwan is described and illustrated. Esterase electrophoresis and scanning microscopy are used for its discrimination from a closely related species, *L. asterivora* Sasakawa. Parasitoids, host plants and mining patterns are also included for the diagnostic discussion.

Key Words.—Diptera, Agromyzidae, *Liriomyza litorea* NEW SPECIES, Taiwan

Liriomyza is one of the largest genera in Agromyzidae (Diptera), over 300 species were recorded throughout the world; it attacks a wide range of crops and the majority of species are leaf miners (Spencer 1973). In Taiwan, this genus was represented by 10 species (Shiao et al. 1991); although it is not dominant in the Oriental and Ethiopian regions (Sasakawa 1972), the newly discovered species did not agree with the other *Liriomyza* species. This article deals with this new species with discussions on its separation from the closely related species, *L. asterivora* Sasakawa, 1956. Furthermore, we follow Zehnder et al. (1983) by using electrophoresis and scanning microscopy for the diagnostic discrimination.

MATERIALS AND METHODS

All materials were collected from the host plants, *Wedelia biflora* (L.) DC., near seashores in Taiwan and Lanyu (Orchid Is.) (Fig. 1) during 1989 to 1991. Larvae were reared on the host plants at $24 \pm 1^\circ$ C until they emerged. Some of the emerged adults were preserved in liquid nitrogen for electrophoretic studies, the others were dried and mounted for morphological observation. Male and female genitalia were dissected after they had been boiled in 15% KOH solution. Esterase electrophoresis were analyzed on 7.5% polyacrylamide slab gels, staining method as described by Ayala et al. (1972). For scanning electronmicrography, gold sputter-coated specimens were examined at 20 KV.

LIRIOMYZA LITOREA SHIAO & WU NEW SPECIES (Fig. 2)

Types.—Holotype: male; data: REPUBLIC OF CHINA. TAIWAN. *Taipei Hsien*: Lungtung, 17 Feb 1990, S. F. Shiao. Paratypes: 5 males, 5 females; *Ilan Hsien*: Peikuan, 17 Feb 1990, S. F. Shiao. 2 males, 2 females; *Pintung Hsien*: Chialeshui, 3 Mar 1991, S. F. Shiao. 6 males, 4 females; *Taitung Hsien*: Lanyu, 6 Nov 1989, S. F. Shiao. 2 males, 3 females; *Taitung Hsien*: Tawu, 25 Feb 1990, Y. C. Shiau. Holotype and paratypes are deposited in the Department of Plant Pathology and Entomology, National Taiwan University, Taipei, Taiwan, Republic of China.

Male.—Body length: 1.8 mm (legs and aristae not included); wing length: 1.5 mm. Head: Face yellow. Frons about $1.4\times$ as wide as eye. Occiput and postgena black, black region contiguous to ocellar triangle and eye. Lunule semicircular, dorsal tip at about $0.5\times$ height of eyes. Antennae yellow, with bases touching each other, 3rd segment rounded in lateral view; arista black, finely pubescent.

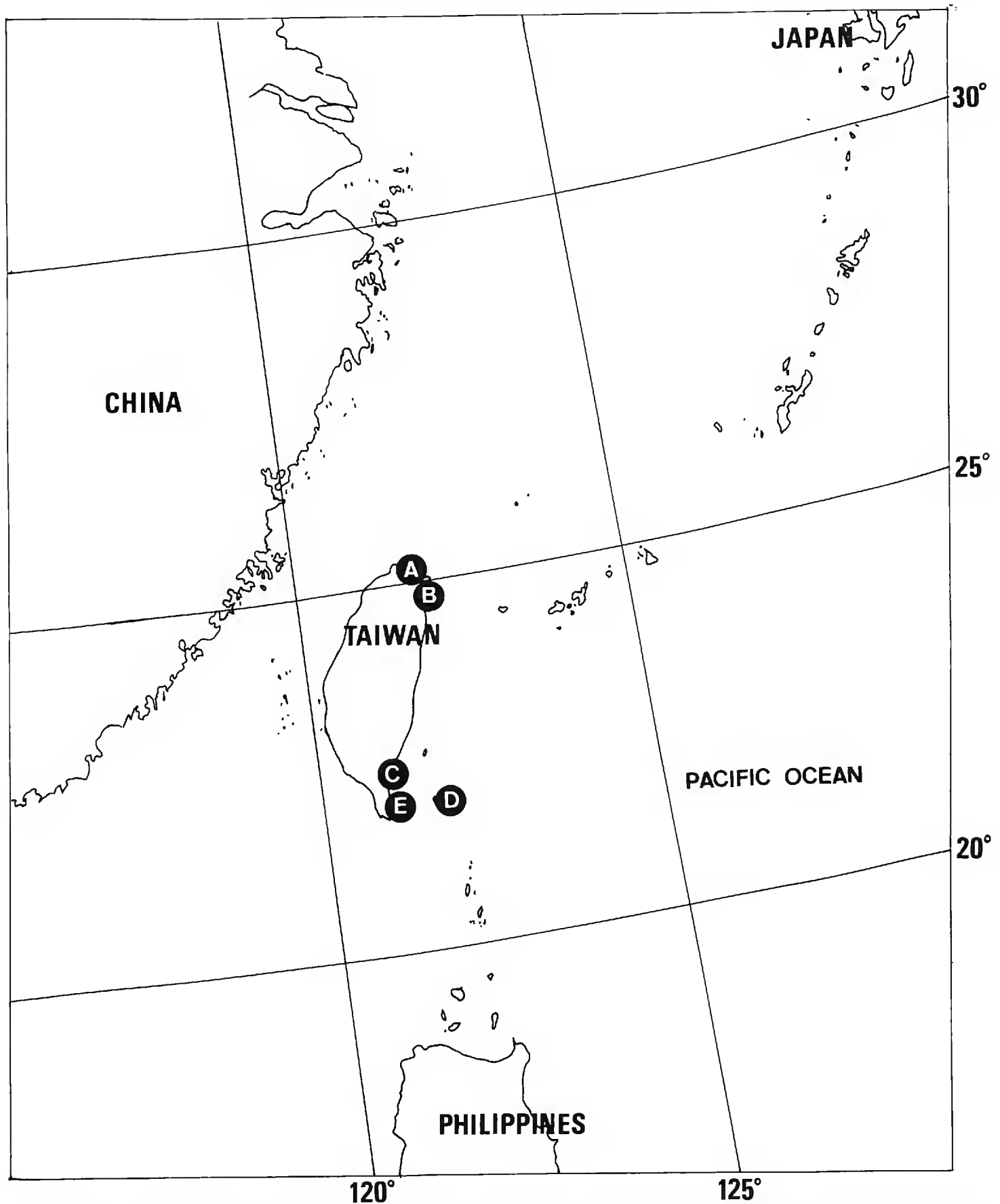


Figure 1. Collecting localities of *Liriomyza litorea* NEW SPECIES in Taiwan. A, Lungtung, Taipei Hsien; B, Peikuan, Ilan Hsien; C, Tawu, Taitung Hsien; D, Lanyu (Orchid Is.), Taitung Hsien; E, Chialeshui, Pintung Hsien.

Orbital setulae long, 5–7 pairs. Orbital bristles 4 pairs, lower 2 pairs obviously inclinate. Vertical angles brown tinged. Vertical bristles 2 pairs, inner pairs on margins of brown ground. Ocellar triangle yellow with 4 long bristles. Thorax: Mesonotum shining black with lateral stripes yellow. Dorsocentral bristles 1 + 3. Acrostichals in 4–5 irregular rows. Scutellum yellow but brown-tinged laterally. Legs with coxae and femora yellow, tibiae and tarsi brown. Wing with costa extending to M_{1+2} ; proportion of 2nd to 4th costal sections, 2.5:1.0:0.7; inner cross vein farther from outer cross vein at about one-third of discal cell. Halter yellow. Abdomen: Tergites brown, covered with long hairs, each segment with a narrow caudal margin yellow tinged; 1st and 2nd tergites with yellow middle furrows. Terminalia:

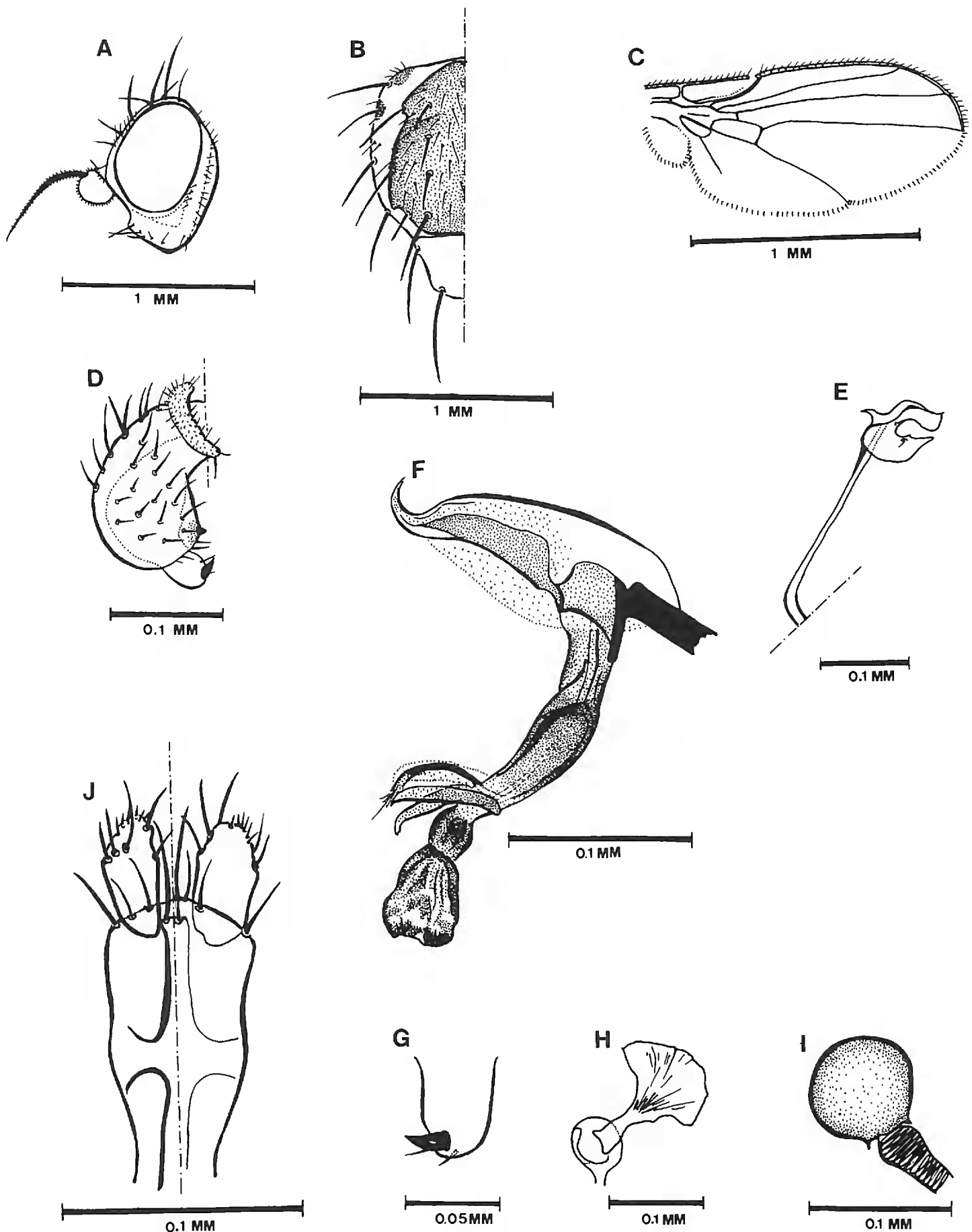


Figure 2. *Liriomyza litorea* NEW SPECIES. A, Head, lateral view; B, Left half of thorax, dorsal view; C, Wing of male; D, Left half of epandrium with one surstylus and one cercus, posterior view; E, Left half of hypandrium, ventral view; F, Distal end of phallapodeme with phallus, lateral view; G, Surstylus, posteroventral view; H, Sperm pump; I, Spermatheca; J, Part of female 9th tergite and sternite with cerci.

Surstylus with 1 spine and 2–3 sensory hairs on tip. Epandrium arched, with 1 pair of short but strong spines on each posteroventral angle. Cercus pubescent. Hypandrium V-shaped as figured. Phallapodeme length 0.65 mm, with distal end hooked. Sperm pump with blade broadened and neck narrowed. Phallus length 0.25 mm; mesophallus with 1 short setal fascicle and 1 pair of processes; endophallus roundly broadened.

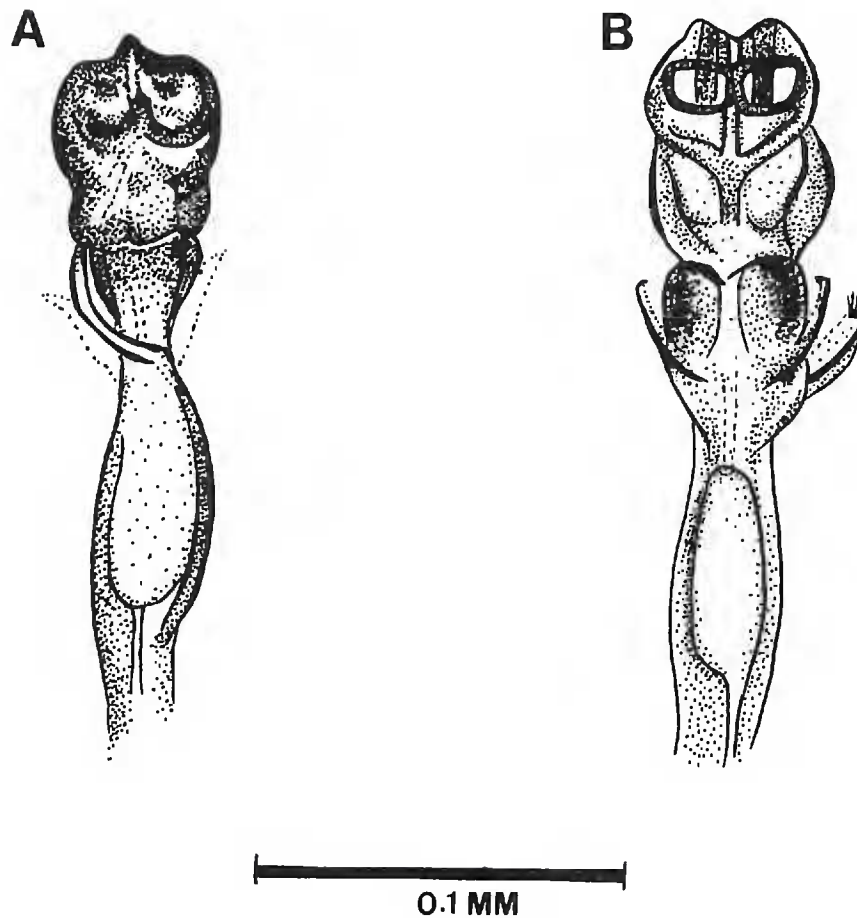


Figure 3. Ventral view of phallus. A, *Liriomyza asterivora* Sasakawa; B, *L. litorea* NEW SPECIES.

Female.—Body length: 2.0 mm; wing length: 1.8 mm. Head, thorax and abdomen: see *Male*. Terminalia: 9th sternite with 3 pairs of marginal setae. Cercus with 5 setae and 6 short tactile sensilla on tip. Spermatheca orbiculated, neck short.

Diagnosis.—*Liriomyza litorea* closely resembles *L. asterivora* but can be distinguished by its brown-tinged vertical angles on head, longer orbital setulae and

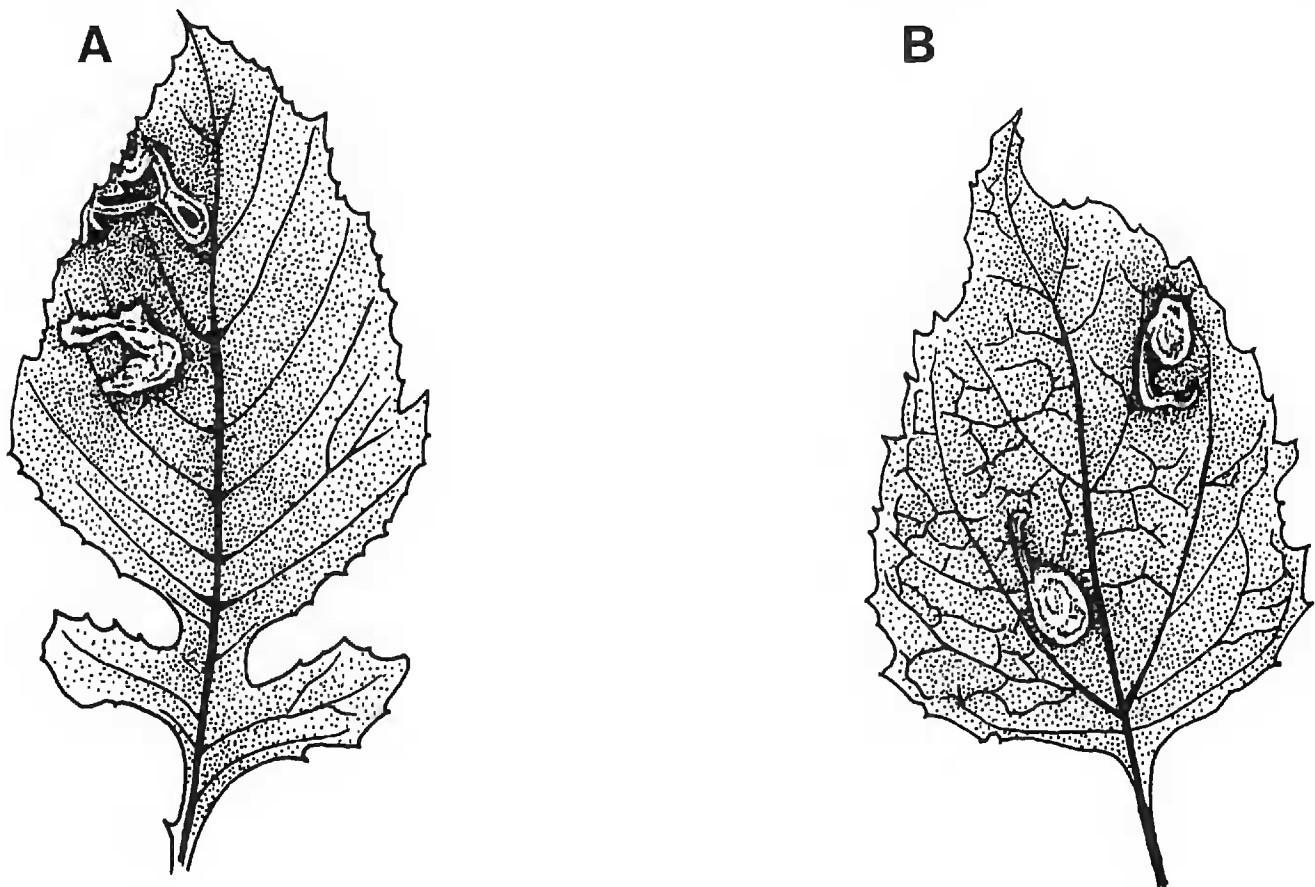


Figure 4. Leaf mines. A, Mines on *Crassocephalum rabens* by *Liriomyza asterivora*; B, Mines on *Wedelia biflora* by *L. litorea* NEW SPECIES.

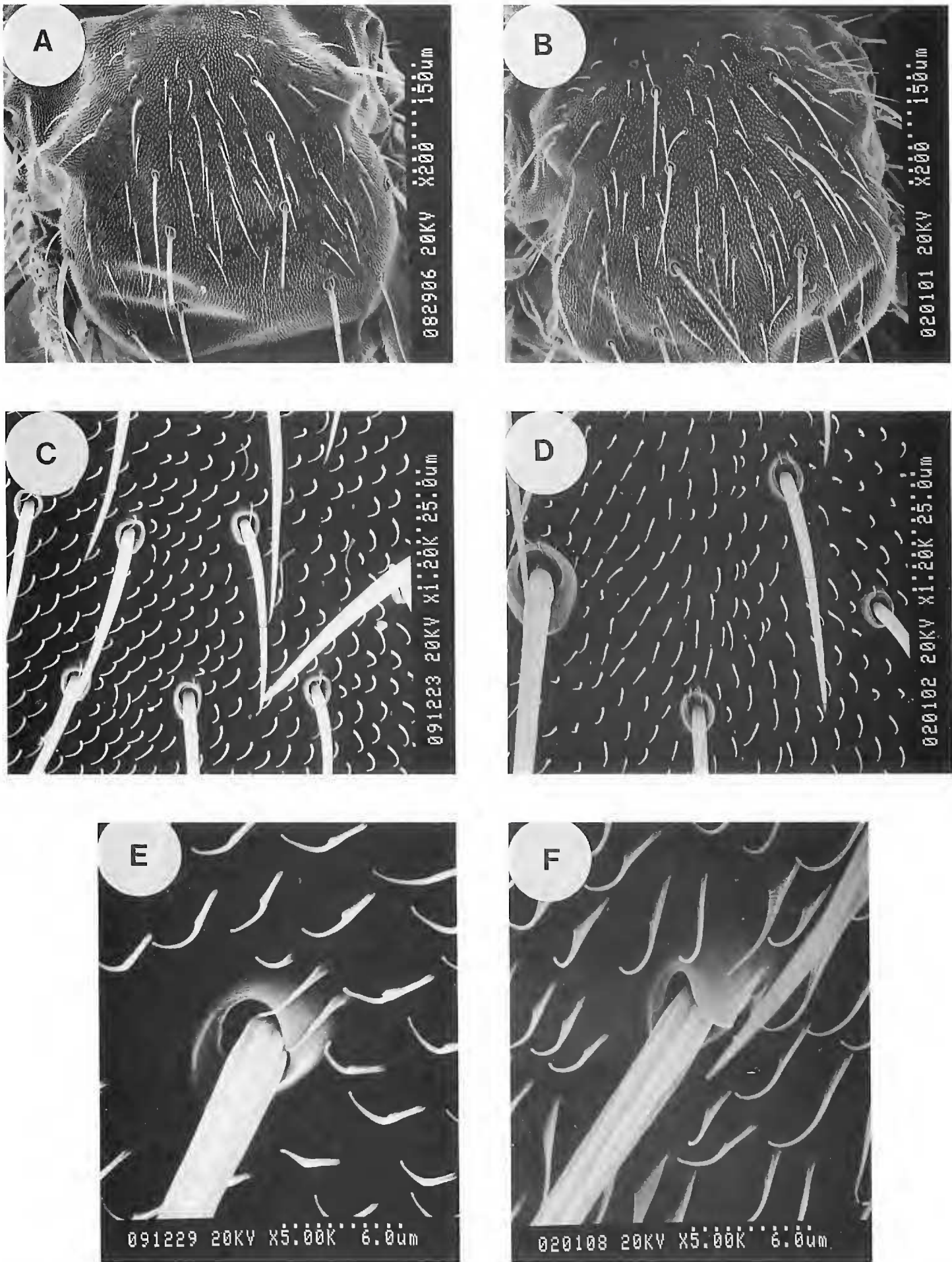


Figure 5. Setae and microsetae on thoracic and abdominal tergites. A, C and E, *Liriomyza asterivora*; B, D and F, *L. litorea* NEW SPECIES; A and B, thorax, dorsal view; C and D, thoracic microsetae, dorsal view; E and F, abdominal microsetae, dorsal view.

strong setae on tergites. Besides, the endophallus and the processes on mesophallus of *L. litorea* are mostly characteristic for separating from other species (Fig. 3).

Distribution.—Only known from Taiwan.

Host Plant.—*Wedelia biflora* (L.) D C. (Compositae).

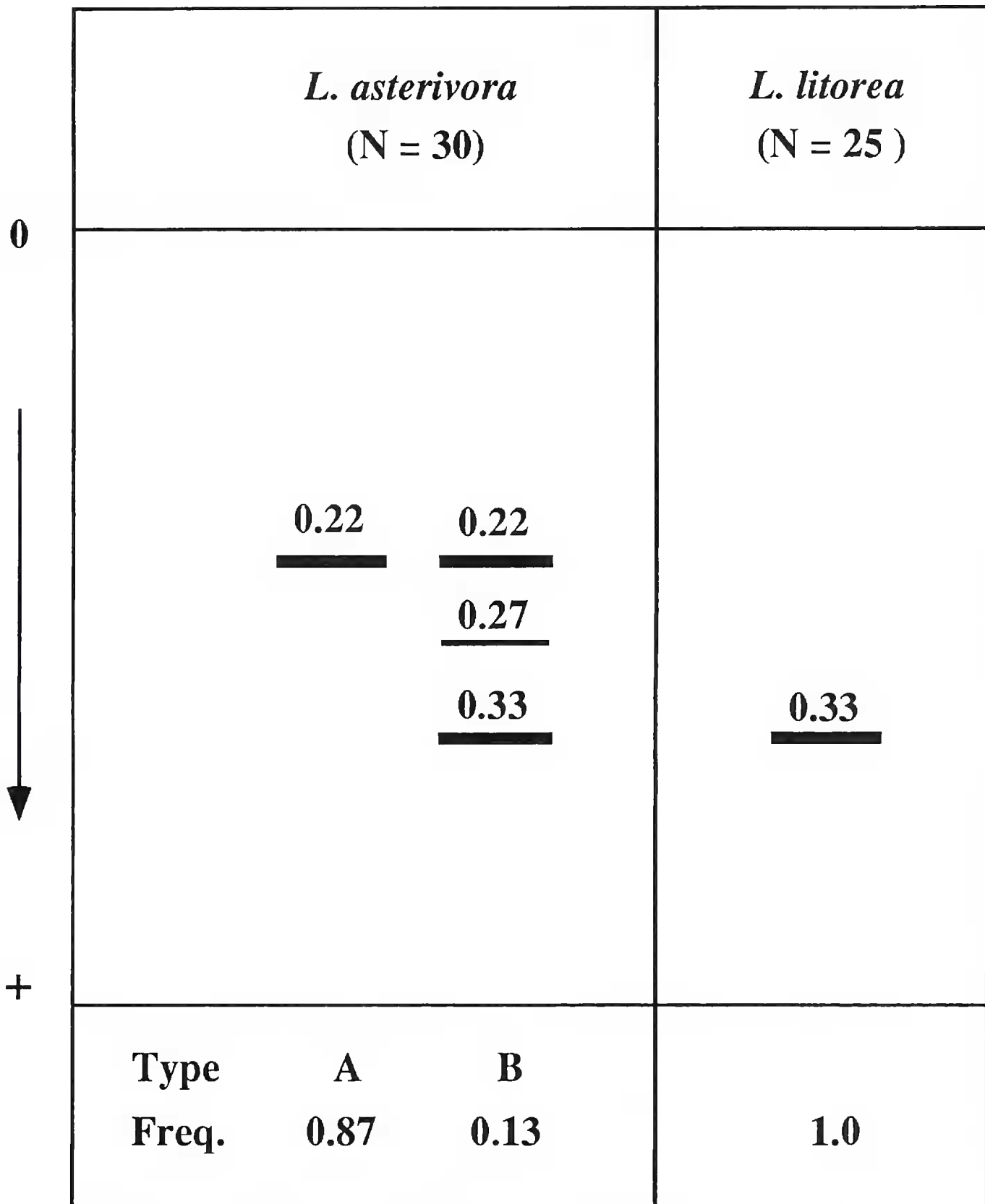


Figure 6. Esterase electrophoretic patterns in *Liriomyza asterivora* and *L. litorea* NEW SPECIES. N, sample size; Type, genotype; Freq., genotypic frequency; numbers above the bands, relative mobility.

Parasitoids. — *Opius (Gastrosema)* sp. and *Bitomus* sp. (Hymenoptera: Braconidae: Opiinae).

Discussion. — After detailed examination, *Liriomyza litorea* is very similar to *L. asterivora* which was also recorded from Taiwan (Shiao & Wu 1989). But we propose the following points of view to support that these newly discovered materials should be treated as a new species.

1. The host plant of *L. litorea*, *Wedelia biflora*, is typically a seashore species that is known to occur in Japan, southeast Asia, tropical Africa and Australia. There were 3 agromyzid species found on *Wedelia* (*Melanagromyza minima*, *M.*

wedeliae and *M. wedeliaphoeta*) (Spencer 1990), and *L. litorea* is the first *Liriomyza* species recorded from this plant. As we described previously in 1989, the preferred host plants of *L. asterivora* in Taiwan is *Crassocephalum rabens* (Juss. ex Jacq.) S. Moore (Compositae), which is widely distributed up to the mountains of 1500 m high; but the distribution of *W. biflora* is definitely restricted to seashores. According to this point, it is confirmed that there should be no gene flow between these two populations.

2. In comparison with *L. asterivora*, the mining patterns presented on *W. biflora* by *L. litorea* are uniquely regular. They are shaped like "comma" marks on all the collected leaves, broadened at the beginning and ending in a slim serpentine (Fig. 4B). Those of *L. asterivora* are much less regular in shape (Fig. 4A).

3. The parasitoids of *L. litorea* were sent to R. A. Wharton, Texas A & M University, for identification; they belong to the genera *Opius* and *Bitomus* (Hymenoptera: Braconidae: Opiinae). The species of *Bitomus* was thought to be a new and important discovery, and probably undescribed (R. A. Wharton, personal communication).

4. The setae and microsetae on thoracic and abdominal tergites can be easily distinguished between *L. litorea* and *L. asterivora* (Fig. 5). The electronmicrography presented the stronger dorsocentral bristles, dense acrostichals and special abdominal microsetae on *L. litorea*. The stronger bristles inspire the adaptation under the special circumstances of seashores.

5. The analysis of esterase electrophoresis showed two types in *L. asterivora* (one is single-banded, the other is three-banded), however only one type in *L. litorea* (single-banded) (Fig. 6). Although the relative mobility of the fast-migrated band in "type B" of *L. asterivora* is the same as the mono-band of *L. litorea*, and if we treat these three electrophoretic types as a dimer of two alleles, the population of *L. litorea* is probably just one of the homozygotes in *L. asterivora*. But the high disequilibrium of allelic frequencies indicates that some disruptive selections force the two populations apart from each other.

Etymology.—From Latin "litoreus," meaning "of the seashore," for this fly is collected from seashores.

Material Examined.—See *Types*.

ACKNOWLEDGMENT

We wish to thank Fei-Jann Lin and Shun-Chern Tsaur, Academia Sinica, Republic of China, for reviewing the manuscript; Robert A. Wharton, Texas A&M University, for identifying the parasitoids and Yih-Cheng Shiau, University of Illinois at Chicago, for supplying materials. This work was funded by the National Science Council, Republic of China (NSC-80-0409-B-002-41 & NSC-84-2321-B-002-119).

LITERATURE CITED

- Ayala, F. J., J. R. Powell, M. L. Tracey, C. A. Mourao & S. Perez-Salas. 1972. Enzyme variability in the *Drosophila willistoni* group. IV. Genic variation in natural populations of *Drosophila willistoni*. *Genetics*, 70: 113–139.
- Sasakawa, M. 1956. New Agromyzidae from Japan XII. *Scient. Rep. Saikyo Univ., Agr.*, 8: 124–131.

- Sasakawa, M. 1972. Formosan Agromyzidae (Diptera). Sci. Rep. Kyoto Pref. Univ., Agr., 24: 43-82.
- Shiao, S. F., F. J. Lin & W. J. Wu. 1991. Redescription of four *Liriomyza* species (Diptera: Agromyzidae) from Taiwan. Chinese J. Entomol., 11: 65-74.
- Shiao, S. F. & W. J. Wu. 1989. Four new records of *Liriomyza* leaf-miners (Diptera: Agromyzidae) from Taiwan. J. Taiwan Mus., 42: 15-23.
- Spencer, K. A. 1973. Agromyzidae (Diptera) of economic importance. Dr. W. Junk B. V. Publisher, The Hague, The Netherlands.
- Spencer, K. A. 1990. Host specialization in the world Agromyzidae (Diptera). Kluwer Academic Publishers, Dordrecht.
- Zehnder, G. W., J. T. Trumble & W. R. White. 1983. Discrimination of *Liriomyza* species (Diptera: Agromyzidae) using electrophoresis and scanning microscopy. Proc. Entomol. Soc. Wash., 85: 564-574.